Homework #4: The Trapezoidal Rule Redux

Due: Thursday, April 4 by 4:00 PM

In class we demonstrated the *trapezoidal rule* numerical integration scheme in which the area under a curve is approximated by a collection of trapezoidal subdivisions whose individual areas are added together. The integral of a function $f(x) = x + 2x \cdot \cos(x^2)$, over the limits from $x = a$ to $x = b$ was approximated by N trapezoidal divisions, and the approximate value of the integral (over this range of x) was given by:

$$\int_{x=a}^{x=b} f(x)\,dx \cong -\frac{\Delta x}{2} \cdot \left[f(a) + f(b) \right] + \Delta x \cdot \sum_{i=0}^{i=N} f(a + i \cdot \Delta x)$$

Where the parameter Δx is the assumed uniform width of the divisions:

$$\Delta x \equiv \frac{b - a}{N}$$

Use the classroom VI formulation as a reference/guide, and create additional solutions for this integration using Matlab scripting, and Excel spreadsheet-based calculations. Show that the results are comparable in numeric value and graphical representation (when compared to your VI results). Choose a range of $0 \le x \le 5$ and number of increments $N=16$ for comparison purposes.

Note that in general, numerical integration techniques are most practical for use when the exact answer is otherwise indeterminate, or for fundamentally discrete data (which we will tackle next week).